IN THE CLAIMS:

Claims 1-10 (canceled)

11. (Currently Amended) A reactor of the staged adiabatic reactor type, comprising:

(a) adiabatic beds of catalyst each including at least one catalyst;

(b) at least one printed circuit heat exchange (PCHE)~~heat exchanger~~ panel interposed between the adiabatic beds of catalyst, wherein a facial area of the heat exchanger panel and a superficial facial area of the catalyst are substantially similar, wherein the heat exchanger panel includes discrete passages for handling reactants and heat transfer media, respectively, and wherein the passages for heat transfer media permit at least two differing flow path directions for the heat transfer media through the heat exchanger panel.

12. (Currently Amended) A reactor according to claim 11, wherein the PCHE ~~heat exchanger~~ panel is comprised of a ~~printed circuit heat exchanger (PCHE), wherein a~~ plurality of plates are superposed and diffusion bonded to form a stack of plates to form the ~~heat exchanger~~PCHE heat exchange panel, wherein fluid passages are defined in the stack by virtue of a pre-treatment of the plates, and wherein each plate is selectively configured to provide either channeled surfaces or blank surfaces in order to obtain a desired pattern of fluid passages in the heat exchanger.

13. (Previously Presented) A reactor according to claim 12, wherein channels are formed by removal of surface material from the plate.

14. (Previously Presented) A reactor according to claim 12, wherein at least one plate includes a passageway in which a heat exchange medium can flow in a first direction and at least one plate includes a passageway in which a heat exchange medium can flow in a second direction that is opposite the first direction.

15. (Previously Presented) A reactor according to claim 12, wherein plates of substantially the same shape are juxtaposed in a stack, each plate having a particular pattern of passages etched out on a surface thereof, and wherein passages in different orientations are defined by alternate alignment of successive plates by rotation of the respective plate in the plane of the plate.

16. (Previously Presented) A reactor according to claim 12, wherein plates lacking channelled surfaces are incorporated in the heat exchanger panel to prevent intermixing of fluids.

17. (Previously Presented) A reactor according to claim 11, further comprising a chemical reaction zone bounded by at least one surface including a heat exchanger that permits heat exchange with fluids flowing through the zone to achieve a reaction, the zone and the surface at least in part being defined by a printed circuit heat exchange (PCHE) panel, the heat exchange panel defining discrete passages providing for flow of fluid reactants and a heat transfer medium, respectively,

wherein at least two different flow paths are defined in the plate for handling the heat transfer medium, and

wherein the heat transfer medium is permitted to pass in at least two differing directions through the fluid flow passages with respect to the flow of fluid reactants through the fluid flow passages.

18. (Previously Presented) A reactor according to claim 17, wherein the fluid flow passages are configured to cause heat transfer medium flowing therethrough to make more than one pass along the length of the plate.

19. (Previously Presented) A reactor according to claim 18, wherein the fluid flow passages comprise serpentine portions including a series of short, sharp turns.

20. (Previously Presented) A reactor according to claim 17, wherein the fluid flow passages comprise a zig-zag pattern imposed upon substantially the whole length of each individual passage.

21. (Currently Amended) A process for performing chemical reactions under controlled temperature conditions, the process comprising:

(a) delivering reactant fluids successively through a chemical reaction zone to achieve a reaction and through a heat exchanger that bounds the chemical reaction zone and that allows heat exchange between the reactant fluids and a heat transfer medium, the heat exchanger at least in part being defined by a printed circuit heat exchange (PCHE) panel providing (1) passages providing for flow of the heat transfer medium therein and (2) passages providing for flow of the reactant fluids therein;

(b) introducing the heat transfer medium to the PCHE panel; and

(c) causing the heat transfer medium to pass in at least two differing directions through the passages in the PCHE panel with respect to the flow of fluid reactants through the passages in the PCHE panel.

22. (Previously Presented) A reactor comprising:

(a) first and second adiabatic beds of catalyst, each of which includes a catalyst,

(b) a heat exchange panel disposed between said first and second beds, the heat exchange panel including;

(1) printed circuit heat exchange (PCHE) plates for receiving heat exchange medium, at least one of the PCHE plates including (i) a heat exchange medium inlet and a heat exchange medium outlet, the inlet and outlet being disposed on opposite ends of the PCHE plate, and (ii) a passage between the heat exchange medium inlet and the heat exchange medium outlet, the passage being configured to permit a heat exchange medium flowing therethrough to flow multiple times across the PCHE plate;

(2) a reactant fluid flow plate having a passage through which reactant fluids can flow, the reactant fluid flow plate being disposed between two PCHE plates, and

(3) a header located external to and at each end of the PCHE plates, each header including a partition to separate the inlet and the outlet at each end.

23. (Previously Presented) A reactor according to claim 22, wherein at least one of the passages comprises serpentine passages.

24. (Previously Presented) A reactor according to claim 22, wherein the heat exchange medium comprises at least one of a molten salt, a molten metal, a hot liquid, a hot gas, a steam, a superheated steam, a chilled liquid, a chilled gas, a vaporizing fluid, and a condensing fluid.

25. (Previously Presented) A reactor according to claim 22, wherein apertures are formed in the plates to form chambers when the plates are attached together.

26. (Previously Presented) A reactor according to claim 22, wherein the passages comprise a zig-zag pattern forming substantially an entire length of each individual passage.

27. (Currently Amended) A reactor comprising:

(a) reaction zones;

(b) a heat exchange~~r~~ panel disposed between said reaction zones, and including at least first and second superposed printed circuit heat exchange (PCHE) plates, wherein surface structures on the PCHE plates form

(i) a heat exchange medium inlet and a heat exchange medium outlet, one of the heat exchange medium inlet and the heat exchange medium outlet being disposed on an upper side of the panel and the other being disposed on a lower side of the panel, and

(ii) a passage between the heat exchange medium inlet and the heat exchange medium outlet, the passage permitting a heat exchange medium to flow horizontally across the panel,

(c) a reactant fluid flow plate through which reactant fluids can flow, the reactant fluid flow plate being disposed between two PCHE plates, the reactant fluid flow plate including:

(i) a reactant inlet and a reactant outlet, the reactant inlet and the reactant outlet being disposed on opposite sides of the reactant fluid flow plate, and

(ii) a passage between the reactant inlet and the reactant outlet, the passage permitting reactant fluids to flow across the reactant fluid flow plate in at least one pass; and

(d) a header located external to and at each end of the reactant fluid flow plate and the PCHE plates, each header including a partition to separate the inlet and the outlet at each end of the respective plate.

28. (Currently Amended) A reactor according to claim 12, wherein at least two differing plate designs are used to make up the panel.

29. (Previously Presented) A reactor according to claim 20, wherein the catalyst bed includes a catalyst comprising one of spherical bodies, cylindrical bodies, hollow bodies, solid particles, expanded particles, pourous solids, wire mesh coated matrix catalyst, and woven gauze coated matrix catalyst.

CONCLUSION

The application has been amended to conform the scope of the heat exchanger recited in claim 1 with the remaining claims and to correct minor informalities. No fees are believed to be payable with this communication. Nevertheless, should the Examiner consider any other fees to be payable in conjunction with this or any future communication, the Director is authorized to direct payment of such fees, or credit any overpayment to Deposit Account No. 50-1170.

The application is now ready for examination on the merits. Early notification of such action is earnestly solicited.

Respectfully submitted,

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